2: Murphy G-4 (no date) 1953 AF15 East China AF15

course depressed by the high figure for raw cotton. Nevertheless it seems clear that Tientsin, despite its rail and water connections and its location in a major cotton-producing area, paid a considerably higher price than Shanghai for delivered raw cotton. If this was true for raw cotton, we may assume that it was true for most of the other industrial raw materials consumed in Tientsin, with the obvious exceptions of coal and the wool, hides and skins of north China, and the possible exception of wheat.* If Tientsin could obtain the necessary raw materials in these latter cases more cheaply than Shanghai, this is further evidence of the paramountcy of the Shanghai market and of the market-oriented character of its manufacturing. If Tientsin paid a higher price than Shanghai for most delivered raw materials, we may assume that other Chinese industrial centers did so too.

Water transport has been a key factor in the development of manufacturing in Shanghai. The city's railway connections are inferior to Tientsin's, and yet its manufacturing apparently paid less for most of its raw materials, and in fact was a greater consumer than Tientsin manufacturing of the leading industrial raw materials of north China: coal, hides, and wheat, all of which can move to Shanghai by sea from north China ports. In turn, the primacy of the Shanghai market depends in large measure on the water transport network which includes half of China in the city's tributary area. The market is able to exercise its attractiveness for manufacturing of all kinds by its ability to draw to its generally resource-poor area by sea and river transport the industrial raw materials which it needs.

Coal and Electric Power

The single most important industrial raw material, coal, has been left for final consideration, since it plays a major role in nearly every industry, directly, or in the form of electric power.

* Shanghai nevertheless led Tientsin in the 1920's and 1930's in the consumption of coal and in the production of leather goods and flour, and in fact shipped nearly 10 per cent of its total flour production to Tientsin on an annual average. (For comparative figures on consumption of coal and production of leather goods and flour, see respectively Leonard Ting, "The Coal Industry in China" (1937), p. 217; Chinese Year Book (1936), p. 1153; Y. C. Chang, "Flour Milling in China" (1922), p. 219).

2: Murphy G-4 (no date) 1953 AF15 East China AF15

438 489 30 per cent by water.[50] Shanghai was thus in a relatively favorable position in being able to draw its coal supplies so largely over water routes. For the period 1930 to 1936, the city imported an annual average of 3.9 million tons of coal from all sources combined.[51] Figures of the Maritime Customs at Shanghai for the same period show an annual average of 3.5 million tons of coal arriving in the city by sea and river[52] (so that railway haulage accounted for less than 10 per cent). Even so, the distances separating Shanghai from its sources of coal made domestic coal more expensive there than for instance in Tientsin, where the cost of Kaiping coal was about 10 per cent less than in Shanghai. Shansi coal, selling for CNC$5 per ton at the pit-head, sold after its long rail haul for CNC$10 at Taku and CNC$12 per ton at Shanghai.[53] (Note that the price doubled between the mines and Taku, but increased by only 20 per cent between Taku and Shanghai, more than twice as long a haul, but by sea rather than by rail.) Shanghai has the advantage of central location, and can draw with equal ease on domestic or overseas coal as prices vary.

● 375 Consumption of coal in the city, according to C. A. Bacon, was divided approximately as shown below.[54]

Users	*Approx. Annual Consumption, in Tons*	
Public Utilities	1,475,000	
electric power companies		1,300,000
gas works		100,000
waterworks		75,000
Other Industries	1,100,000	
Households	500,000	
Shipping	400,000	
Railways	350,000	
Miscellaneous	50,000	
TOTAL	3,875,000	

365 According to these figures, 37 per cent of Shanghai's coal consumption was accounted for by the electric power companies. There were four of these companies in the 1930's, of which the Shanghai Power Company (sold by the Shanghai Municipal Council to an American company in 1929, and in 1949–50 taken over by the Com-

3: Hinder G-5 (1933-1942) 1944 AF15 East China AF15

The experiment could not be carried out to its logical conclusion, however, because after the spring of 1939, when the Japanese instituted controls over the cocoon output in the provinces, it became increasingly difficult to obtain cocoons from these areas. By the end of 1940 only two or three filatures were still operating, and the spring of 1941 saw very few cocoons reaching Shanghai.

DESPITE THE LACK of legal powers, it proved possible radically to reform the manufacture and operation of steam pressure vessels. Prior to 1936, when the institution of controls began, local boiler yards manufactured boilers almost exclusively from metal plate of unknown quality and test, and from designs which did not conform to accepted standards. Neither owners nor workers in the boiler yards had the necessary knowledge for an engineering task requiring special training. The result was that hundreds of initially unsatisfactory boilers had been installed. Regular inspection of them was unknown. Explosions were frequent, at times accompanied by loss of life; and the wonder was that they did not occur almost every day.

In 1936 the Council adopted rules governing vessels and systems under pressure, and for the registration of boiler yards. By the rules all local boiler yards had to employ the services of a Council-approved boiler surveyor who would design and supervise the construction of all vessels. Boilers had to be inspected and registered. Thereafter annual re-inspection was required. A roster of qualified engineers of all nationalities was obtained with the assistance of a specially appointed Boiler Board.

Although the regulations carried no penalty clause, it proved possible to apply them to a very considerable extent. All of the 34 boiler yards in the Settlement were registered, and no boiler after 1936 was manufactured or extensively repaired in them unless a permit therefor had previously been obtained. Qualified boiler surveyors supervised the construction and repair, and submitted copies of certificates describing the metal plate used. Considering the steep rise in the price of imported steel during those years, a result of higher world prices and the lower exchange value of the Chinese dollar, it is noteworthy that tested steel became universally used in pressure vessels manufactured in the Settlement.

3: Hinder G-5 (1933-1942) 1944 AF15 East China AF15

There remained much to be done before the goal of regular annual inspection of all pressure vessels could be achieved.[10]

In July 1940 licence conditions under Byelaw 35 were instituted as a measure to control the use of celluloid and allied substances.[11] In 1939, twenty fires had occurred on premises associated with the use of these substances, involving the loss of 28 lives (50 per cent of all deaths in factory fires during that year), and an additional 35 persons were injured. In 1940 there were 15 fires with five deaths in factories using celluloid and cellulose spray paint. Many very small enterprises, operating on domestic premises and manufacturing such items as spectacle frames, combs and small toys, constituted a real danger. Cellulose spray painting operations were widespread. Use of a portable spray gun makes this type of work possible on all kinds of premises. The Division required installation of suitable exhaust ventilation in factories using cellulose spray paint and refused special "hazardous goods licences" for spraying operations in unsuitable premises. Progress was consequently made in removing this particular danger.

From July 1941, all enterprises handling hazardous liquids as alcohol, ether, amyl acetate, etc., also became subject to licence. When mixed with air in certain proportions, these liquids are explosive in addition to possessing inflammable properties. With the licence system, factories manufacturing alcohol, and others using gasoline as a solvent in the manufacture of rubber shoes, or amyl acetate as a solvent in the handling of celluloid, were brought under the control of the authorities. Failure to comply with requirements rendered a factory occupier liable to legal prosecution, but the comparatively small fine applicable was but a slight deterrent. Only after several court charges could Article 18[12] in

[10] By the end of 1940, 1,167 pressure vessels (including 969 boilers) were registered, and the Council's identification number had been stamped on 613 of these. In 1940, 440 inspection certificates were executed by Council-approved boiler surveyors. The 1941 figures showed a small improvement.

[11] Byelaw 35 reads: "No person shall keep, store, sell or manufacture any firearms other than those used solely for sporting, volunteer or police purposes, or any dangerous or inflammable materials, namely those which on account of fire or explosion may endanger life or property . . . or carry on any dangerous or hazardous trade . . . without a licence first obtained therefor from the Municipal Council, and in the case of a foreigner countersigned by his consular authority."

[12] The Article reads: "Prohibition of business may be ordered when the offender is found guilty of recidivism in respect of a similar offence."